

Claims

- [c1] 1.A downhole formation heating system for a wellbore including a well casing, the system comprising:
- (a)a gas burner comprising a cylindrical housing defining an intake opening and a flue opening, the housing comprising means for receiving a supply of fuel and air; a mixing zone where the fuel and air are mixed; an ignition zone comprising an igniter and a reaction zone, each zone comprising a packed bed of porous media;
 - (b)an igniter for igniting the fuel and air within the gas burner;
 - (c)fuel and air supply tubing for delivering fuel and air to the burner; and
 - (d)means for delivering pressurized air or an inert gas in an annular space between the well casing and the fuel and air supply tubing.
- [c2] 2.The system of claim 1 wherein the porous media comprises ceramic beads.
- [c3] 3.The system of claim 2 wherein the ceramic beads comprises alumina beads.
- [c4] 4.The system of claim 1 wherein the mixing zone and

reaction zone comprise a pore size less than a minimum quenching distance under standard conditions of a fuel gas and the ignition zone comprises a pore size greater than the minimum quenching distance under standard conditions of the fuel gas.

- [c5] 5.A method of heat treating a formation comprising the steps of:
- (a) inserting a gas burner comprising a cylindrical housing defining an intake opening and a flue opening, the housing comprising means for receiving a supply of fuel and air; a mixing zone where the fuel and air are mixed; an ignition zone comprising an igniter and a reaction zone, each zone comprising a packed bed of porous media, into a wellbore;
 - (b) injecting a fuel gas and air into the gas burner to create a combustible mixture and igniting the mixture to create a combustion front; and
 - (c) causing the combustion front to travel out the gas burner and into the formation.
- [c6] 6.The method of claim 5 wherein one zone of the gas burner has a pore size smaller than a minimum quenching distance for an operating condition of pressure and fuel.
- [c7] 7.A gas burner comprising a tubular housing adapted to

operate in a pressurized environment, the housing defining an intake opening and a flue opening and comprising means for receiving a supply of fuel and air; a mixing zone where the fuel and air are mixed comprising a packed bed of porous media; an ignition zone comprising a packed bed of porous media, and a reaction zone comprising a packed bed of porous media; wherein the pore size of the mixing zone and the reaction zone is smaller than a minimum quenching distance of a fuel gas under standard conditions while the pore size of the ignition zone is larger than the minimum quenching distance.

- [c8] 8. The burner of claim 5 wherein the flue opening combines with a pressure regulator for controlling the pressure within the gas burner above atmospheric pressure.